THAT WHICH IS CLAIMED:

1. A system for cooling a fiber amplifier, the system comprising:

a fiber amplifier assembly comprising:

a longitudinally-extending fiber amplifier;

a jacket surrounding the fiber amplifier and extending at least partially longitudinally therealong, wherein the jacket surrounds the fiber amplifier such that the fiber amplifier assembly defines a passage between the jacket and the fiber amplifier for the circulation of coolant therethrough; and

a retaining structure disposed within the passage defined by the fiber amplifier assembly for at least partially maintaining a spacing between the fiber amplifier and jacket, wherein the retaining structure and coolant comprise an emulsion of phase change material.

2. A system according to Claim 1 further comprising:

a thermal management system capable of circulating coolant through the passage defined between the jacket and fiber amplifier of the fiber amplifier assembly.

3. A system according to Claim 2, wherein the thermal management system is capable of placing coolant in thermal communication with the fiber amplifier such that the coolant is capable of carrying heat away from the fiber amplifier, and wherein the thermal management system is capable of rejecting the heat carried away by the coolant.

4. A system according to Claim 3, wherein the thermal management system is capable of placing coolant in thermal communication with the fiber amplifier such that the coolant is capable of at least partially melting to thereby carry heat away from the fiber amplifier, and wherein the thermal management system is capable of condensing at least a portion of the at least partially melted coolant to thereby reject the heat carried away by the coolant.

5. A system according to Claim 1, wherein the fiber amplifier assembly defines a passage between the jacket and the fiber amplifier for the circulation of

coolant selected to have a refractive index smaller than a refractive index of the fiber amplifier.

6. A system according to Claim 1, wherein the emulsion of phase change material comprises a plurality of phase change materials suspended in a carrier fluid, wherein each phase change material comprises an encapsulated composition.

7. A system according to Claim 6, wherein the phase change materials are positioned within the passage such that the phase change materials remain at least partially stationary.

8. A system according to Claim 7, wherein the fiber amplifier assembly defines a passage between the jacket and the fiber amplifier such that the phase change materials remain at least partially stationary and the carrier fluid circulates through the passage.

9. A system for cooling a fiber amplifier, the system comprising:

a fiber amplifier assembly comprising:

at least one sheet spacer; and

a longitudinally-extending fiber amplifier capable of being mounted in a serpentine manner through the at least one sheet spacer to thereby maintain separation between portions of the fiber amplifier, and to define a passage between the portions of the fiber amplifier for the circulation of coolant therethrough.

10. A system according to Claim 9 further comprising:

a thermal management system capable of circulating coolant through the passage defined between the portions of the fiber amplifier of the fiber amplifier assembly.

11. A system according to Claim 10, wherein the thermal management system is capable of placing coolant in thermal communication with the fiber amplifier such that the coolant is capable of carrying heat away from the fiber

amplifier, and wherein the thermal management system is capable of rejecting the heat carried away by the coolant.

12. A system according to Claim 11, wherein the thermal management system is capable of placing coolant comprising an emulsion of phase change material in thermal communication with the fiber amplifier such that the coolant is capable of at least partially melting to thereby carry heat away from the fiber amplifier, and wherein the thermal management system is capable of condensing at least a portion of the at least partially melted coolant to thereby reject the heat carried away by the coolant.

13. A system according to Claim 9, wherein the fiber amplifier is capable of being mounted in a serpentine manner through the at least one sheet spacer to define a passage between the portions of the fiber amplifier for the circulation of coolant selected to have a refractive index smaller than a refractive index of the fiber amplifier.

14. A system according to Claim 6, wherein the fiber amplifier is capable of being mounted in a serpentine manner through the at least one sheet spacer to define a passage between the portions of the fiber amplifier for the circulation of coolant comprising an emulsion of phase change material.

15. A system according to Claim 9, wherein the at least one spacer is embodied in woven fibers positioned to thereby maintain separation between portions of the fiber amplifier, and to define a passage between the portions of the fiber amplifier for the circulation of coolant therethrough.

16. A method of cooling a fiber amplifier, the method comprising:

providing a cooling structure comprising:

jacket surrounding a longitudinally-extending fiber amplifier, and extending at least partially longitudinally therealong such that a passage is defined between the jacket and the fiber amplifier; and

a retaining structure disposed within the passage defined by the fiber amplifier assembly for at least partially maintaining a spacing between the fiber amplifier and jacket; and

circulating coolant through the passage defined between the jacket and the fiber amplifier, wherein the retaining structure and coolant comprise an emulsion of phase change material.

17. A method according to Claim 16, wherein circulating coolant comprises:

placing coolant in thermal communication with the fiber amplifier such that the coolant is capable of carrying heat away from the fiber amplifier; and

rejecting the heat carried away by the coolant.

18. A method according to Claim 17, wherein placing coolant in thermal communication with the fiber amplifier comprises placing coolant in thermal communication with the fiber amplifier such that the coolant at least partially melts, and

wherein rejecting the heat carried away by the coolant comprises condensing at least a portion of the at least partially melted coolant.

19. A method according to Claim 16, wherein circulating coolant comprises circulating coolant selected to have a refractive index smaller than a refractive index of the fiber amplifier.

20. A method of cooling a fiber amplifier, the method comprising:

mounting a longitudinally-extending fiber amplifier in a serpentine manner through a at least one sheet spacer to thereby maintain separation between portions of the fiber amplifier, and to define a passage between the portions of the fiber amplifier; and

circulating coolant through the passage defined between the portions of the fiber amplifier.

21. A method according to Claim 20, wherein circulating coolant comprises:

placing coolant in thermal communication with the fiber amplifier such that the coolant is capable of carrying heat away from the fiber amplifier; and

rejecting the heat carried away by the coolant.

22. A method according to Claim 21, wherein placing coolant in thermal communication with the fiber amplifier comprises placing coolant comprising an emulsion of phase change material in thermal communication with the fiber amplifier such that the coolant at least partially melts, and

wherein rejecting the heat carried away by the coolant comprises condensing at least a portion of the at least partially melted coolant.

23. A method according to Claim 20, wherein circulating coolant comprises circulating coolant selected to have a refractive index smaller than a refractive index of the fiber amplifier.

24. A method according to Claim 20, wherein circulating coolant comprises circulating coolant comprising an emulsion of phase change material through the passage defined between the portions of the fiber amplifier.